UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS CENTRE FOR HUMAN SETTLEMENTS (HABITAT)

SECOND CONSULTATION ON THE BUILDING MATERIALS INDUSTRY

Athens, Greece, 4–8 November 1991

Distr.
LIMITED

ID/WG.510/2
2 May 1991

ORIGINAL: ENGLISH

Issue Paper II*

MEASURES TO STRENGTHEN THE LOW-COST BUILDING MATERIALS INDUSTRY IN DEVELOPING COUNTRIES

Prepared by

UNCHS (Habitat)

* This document has not been edited.

V.91-24009

CONTENTS

	Paragraphs	Page
I. INTRODUCTION	1-3	3
II. THE SIGNIFICANCE OF LOW-COST BUILDING MATERIALS FOR THE SHELTER SECTOR	4-12	3-5
III. CONSTRAINTS IN THE DEVELOPMENT OF THE LOW-COST BUILDING MATERIALS INDUSTRY	13-31	5-10
(a) Technology of production	15-18	5-6
(b) Investment requirements	19-24	6-8
(c) Quality of output	25-28	8-9
(d) Demand for indigenous materials	29-30	9
(e) Use of low-cost materials in construction	31	10
IV. FINAL CONSIDERATIONS	32-36	10-12

I. INTRODUCTION

1. The increasing urbanization and industrialization in developing countries, and the global commitment to ensure shelter for all by the year 2000, require an assured supply of a range of building materials that can meet the requirements of different sectors: urban and rural, buildings and civil works, formal and "informal" construction activities, etc. Traditionally, developing countries have met a significant part of this demand through imports. In many developing countries, import of building materials reached a very high level by the late sixties. With the widening gap in balance of payments since the early seventies, national priorities in developing countries have veered towards increased self-reliance in all spheres of the economy. Thus, in the building materials sector, emphasis has shifted to increasing local production and greater utilization of natural resource endowment.

2. Issue Paper I focuses the attention of the Consultation on possible strategies and policies, at national level, that could stimulate the development of the building materials industry in developing countries. While providing a general overview of the characteristics of the building materials industry, it specifically addresses the core building materials industry: production of cement, clay products, wood, iron and steel, sheet glass, and thermoplastics, and examines the demand and supply side constraints that need to be tackled to bridge the current demand-supply gap.

3. The present Issue Paper, highlights the critical and complementary role of the low-cost small-scale building materials industry in ensuring a steady supply of building materials such as alternative binders, blocks and bricks, commercially less accepted species of timber, agricultural and industrial wastes, etc. to the construction industry, particularly the low-cost shelter sector. The paper then proceeds to examine the special structural constraints peculiar to this sector, and finally, draws the attention of the Consultation to the key areas requiring intervention for sustained growth of the low-cost building materials industry.

II. THE SIGNIFICANCE OF LOW-COST BUILDING MATERIALS FOR THE SHELTER SECTOR

4. There is a growing concern among the developing courtries that the persistent shortage of low-cost building materials that are durable but can be afforded by the vast majority of the population, is a serious impediment in improving housing conditions of the people. The problem is particularly acute among the urban low-income groups, which constitute nearly half of the urban population living in inner-city slums and in improvised housing on the fringes of urban areas, who, unlike their rural counterparts, do not have access to traditional non-monetary inputs like clay, stones and vegetal materials from the forests for their building needs.

5. Even in rural areas, the free availability of natural resources such as forestry thinnings, has dwindled over the years with stricter control by governments on forestry resources. However, the area where the rural housing sector is most affected by the shortage of low-cost building materials, is in upgrading the temporary and semi-permanent dwellings which constitute the vast majority of the rural housing stock. This is despite the fact that basic raw materials such as clay, limestone, gypsum, etc. abound in rural areas (even though often in small deposits) and, with little effort, can be exploited for local production of low-cost but durable building materials.

6. The scarcity of low-cost building materials will only intensify with the years, and will frustrate the objectives of the Global Shelter Strategy 1/ and all efforts of the national governments unless concrete and practical steps are taken to drastically improve the availability of affordable building materials to meet the housing needs of the low-income groups.

7. Research and development carried out in recent years have effectively demonstrated that building materials produced entirely from local resources, using simple small-scale production technologies, requiring limited skills that can be found locally, can possess the properties of strength, water resistance and durability required for fully permanent construction. Thus, manually produced burnt-clay bricks, adobe, or stabilised soil blocks, lime-based cements and timber (particularly, locally-available secondary species), if carefully selected, processed and used, can be as satisfactory as factory-made materials such as Portland cement, cement-based blocks, or steel sheet roofing, and can be made available at reduced costs. There are other newly developed materials too, such as rice-husk ash cement, sulphurcrete blocks and fibre-concrete roofing which can provide alternatives without involving costly processing plants, or the import of raw materials or equipment 2/.

8. Despite the foregoing, the local building materials industries in many developing countries have failed to fully commercialise these innovations thus missing tremendous opportunities for indigenisation of the sector, creation of significant additional employment, particularly in local areas, and above all, making available a free supply of low-cost building materials for low-income house-builders.

9. Several factors have inhibited the growth of the low-cost locally-produced building materials sector. The most important among these is the erratic and often low quality of local production that has failed to inspire the confidence of even the less demanding low-income house-builders. Thus, lime and bricks produced in traditional clamp-type kilns or soil blocks, produced by the roadside without proper admixture or compaction, suffer from user prejudices because of their poor and uncertain quality.

10. In addition, the low-cost building materials industry, operating largely in the informal sector, generally suffers from a lack of basic production management capability often operating at a scale that does not permit viable production. Low productivity and wasteful energy consumption also add to the cost of production. All these factors combine to eliminate the natural price advantage of locally-produced materials shifting the user preferences to conventional building materials, often of imported origin or with substantial import content (in raw materials, equipment, energy, etc.) produced by the modern sector.

11. A systematic analysis of the underlying factors that affect the wide-scale production of low-cost locally-produced building materials will be facilitated if these building materials are suitably grouped based on the origin of raw materials, their functional characteristics and production technologies. Such a grouping could lead to the following divisions:

1/ The Global Strategy For Shelter To The Year 2000, UNCHS, HS/185/90/E, 1990

2/ A Compendium of Information on Selected Low-Cost Building Materials, UNCHS, HS/137/88/E.

(a) Small-scale manual production of bricks and tiles;
(b) Use of soils in blocks and rammed-earth construction;
(c) Low-cost binders;
(d) Fibre-concrete roofing;
(e) Application of commercially less-accepted species (CLAS) of timber;
(f) Use of agricultural wastes;
(g) Other innovative low-cost materials.

12. The Consultation may, therefore, like to focus the deliberations specially on the above group of low-cost building materials so that conclusions and recommendations of the Consultation can provide direct and practical guidelines for the promotion of each identified group of materials.

III. CONSTRAINTS IN THE DEVELOPMENT OF THE LOW-COST BUILDING MATERIALS INDUSTRY

13. The problems relating to wide-scale production of low-cost indigenous building materials are many and they often differ from country to country. However, one characteristic that is generally common to most developing countries is the central role that the small-scale and informal sector play in the production of these materials. While the small producers have the advantage of flexibility in operation and in the shifting and volatile markets of the developing countries, by locating plants close to raw material deposits and product markets, and because of their labour-intensive operations, they suffer from several structural constraints, such as their inaccessibility to formal sources of capital or credit, or their inability to acquire vital inputs such as key raw materials, new technology, equipment, energy, etc. The dearth of managerial skills that is common to this sector also contributes to their inability to do forward planning to offset shortages in basic raw materials, or to overcome difficulties in penetrating formal sector markets. Thus, many of the constraints in increasing the production of low-cost building materials are directly related to the operational problems of the small producers.

14. Broadly, the constraints facing the low-cost building materials industry may be categorised as those related to: (a) technology of production; (b) investment requirements; (c) quality of output; (d) demand for indigenous materials; and (e) use of low-cost building materials in construction 3/.

(a) Technology of production

15. Technological inputs needed in low-cost building materials industries may widely differ from country to country and from industry to industry. Thus, some industries may need infusion of new technology (for example, vertical shaft kiln technology for lime production or continuous brick kilns to replace old clamp-type kilns), while others may need to upgrade the existing technology to improve its operational efficiency or to modify the operating process, by, for example, using alternative fuels. In some instances (as in fibre-concrete roofing sheets) slight improvements in the quality of the product may be more important to gain an edge in the market rather than attempts at technological breakthroughs.

16. The first prerequisite in each case is, however, the effective dissemination of technological information to the industry at local level. Experience has shown that the process of dissemination, particularly across

---

3/ The Use of Selected Indigenous Building Materials with Potential for Wide Application in Developing Countries, UNCHS, HS/03/05/E, 1985

national borders is often very slow. The channels of communication, even at regional level, are far from adequate. Even though international agencies like UNCHS (Habitat) have published a compendium of information on recent innovations in low-cost building materials technology, local research and development institutions have often been unable to widely disseminate this information to local producers and to demonstrate their viability on an adequate scale 4/.

17. Secondly, few technology suppliers have emerged in developing countries in the field of low-cost building materials. There are some exceptions, however. In India, for example, the Cement Research Institute has developed and licensed rice-husk-ash-cement plant, while the Khadi and Village Industries Commission has been active in establishing lime and lime-pozzolana production units. In the Philippines, the Forest Products Research and Development Institute and the Philippines Coconut Development Authority are actively engaged in research and development for the promotion of coconut wood in low-cost housing 5/. However, most developing countries need to strengthen government policies and institutional support measures in this area.

18. In the limited cases where technologies for production of low-cost building materials have been developed through indigenous efforts, or an innovative technology has been acquired by a national R+D Institution and adapted to suit local needs, the limited absorbtive capacity of small producers has come in the way of commercialization of such innovations. With very little risk-capital at their disposal, they are generally unwilling to venture into market uncertainties. On the other hand, large commercial interests have so far done little to promote new technologies for low-cost building materials. There are a few cases of active support by state industrial development agencies to the small-scale building materials sector, for example, the Small Industries Development Organisation, in Tanzania, which has been supporting small entrepreneurs with credit, infrastructural facilities, skills and entrepreneurial development training, and import of equipment for pilot plants (e.g. to set up vertical shaft lime kilns and for manufacture of sisal fibre-roofing sheets) 6/. It will be useful for other developing countries to emulate such examples.

(b) Investment requirements

19. An important prerequisite for investment in the building materials industry is information on raw materials deposits. Low-cost building materials industries mostly operate on a small-scale and can utilise small-scale deposits of clay, limestone, gypsum, pozzolana, etc. located close to product markets. However, very little information about small-scale deposits is generally available in developing countries. Practically, no information exists about the proven reserves of these deposits or the quality of raw materials. Small-scale entrepreneurs can ill-afford to finance such pre-investment studies and, therefore, need support from the government (e.g., geological survey agencies) to make available such information at nominal

---

4/ Ibid.

5/ R.N. Palomar and J.O. Siopongoo. Technology Manual on Coconut Wood as Construction Material, UNDP/UNIDO Regional Network in Asia-Pacific for Low-Cost Building Materials Technologies and Construction Systems.

6/ Case Study on Tanzania - A Strategy for the Development of the Building Materials Sector (UNCHS, unpublished report, March 1990).

cost. Active support from the government in prospecting these deposits will not only help the building materials sector but will also facilitate exploitation of these unutilised natural resources.

20. The viability of small-scale production of indigenous building materials is also affected by the lack of access roads or because of the non-availability of a suitable site for the production plant which ideally should be within an acceptable distance from the source of raw materials. For example, the lime-pozzolana industry in Rwanda exploits limestone deposits from a source five kilometres away from the factory, while the pozzolana is derived from a volcanic ash cone situated about 40 kilometres from the plant 1/. This seriously affects the competitiveness of the alternative binder vis-a-vis Portland cement.

21. The overall capital requirements for the production of most indigenous building materials are relatively low and can generally be met from the domestic resources of developing countries. Materials like lime, bricks, soil blocks etc., can be produced by the small-scale sector with almost all the capital requirements being met from local sources traditionally accessible to small producers. For instance, the investment requirements for production of gypsum mortar can be as low as US$2,500 per thousand tons of annual production as against US$120,000 for the same output of cement mortar 8/. However, there are at least two areas where the capital requirements usually exceed the capacity of small-scale enterprises. The first relates to the need of equipment and machinery that cannot be produced indigenously. For example, a ball mill required to grind pozzolana to the requisite fineness will often have to be imported at a cost which can only be met by many small enterprises with credit support. Yet, in many developing countries, the majority of small enterprises have little access to formal sources of capital or credit, thus forcing them to rely upon the limited savings and borrowing of families and friends. This often acts as a serious constraint to the entry of small-scale entrepreneurs to the low-cost building materials industry.

22. The small-scale sector also generally operates with inadequate working capital which prevents the building up of adequate stock of either raw materials or finished products. A case in point is the use of agricultural residues such as rice husk for production of pozzolanas, or coffee husk as a source of fuel. The seasonal availability of these materials requires building up of adequate stock during harvest time to ensure continued production. Shortage of capital thus forces small producers to operate a sub-optimal levels unresponsive to market demand. This seriously affects their long-term prospects for capacity expansion and healthy growth. Further, it underscores the need for policy measures that would promote credit expansion by state financial institutions, particularly in the rural and small-scale sectors, uninhibited by high administrative costs.

23. The training needs of the low-cost indigenous building materials industries are broadly at artisan, supervisory and managerial levels. Skill requirements at artisan levels can generally be met from the vast reservoir of unskilled and semiskilled labour available in most of the developing countries. Skills upgrading generally takes place in the industry through on-the-job or in-plant training with minimal disruption to the production process. There is now, in fact, considerable evidence that the small-scale

---

1/ UNCHS, HS/83/85/E, 1985, op. cit. p. 46
8/ Ibid

and informal sectors, which dominate the low-cost building materials industry, are a veritable training ground for industrial skills providing useful linkages to the modern sector 9/. However, additional training needs exist, particularly concerning special skills in industries acquiring innovative technologies, e.g. in improved brick or lime kilns where process control is rather complex. Usually, acquisition of such skills is an integral part of the technology acquisition process and is generally provided by the supplier or transferer of such technologies. Institutional promotional measures required for this purpose have already been discussed under para 15. Supervisory skills are generally acquired through experience, and on-the-job training, as the artisans graduate over a period of years to supervisory levels.

24. However, the low-cost building materials industries significantly suffer from limited operational efficiency, primarily owing to low levels of managerial and entrepreneurial skills, such as inability to (a) plan ahead; (b) ensure uninterrupted supply of basic inputs; (c) adapt to market variations; and (d)expand the market share for sustained growth. The levels of managerial skills, however, vary from country to country and from region to region. The need is highest in African countries; Asian and Latin American countries have shown rapid development in recent years. This, perhaps, provides the basis for sharing of experience through international co-operation. Ultimately, however, upgrading of managerial skills at the industry level will depend on strengthening institutional measures at national level, and also on increased interaction between the modern and the traditional sectors of the industry.

(c) Quality of output

25. One of the reasons for the poor quality of finished products of low-cost building materials is the lack of attention given to the quality and grade of raw materials used in production. Most low-cost building materials production facilities make use of locally-available deposits for their raw material requirements. Few, however, make a distinction in the variations in quality of such raw materials. On the other hand, for most indigenous cementitious materials, such as lime, gypsum and rice-husk-ash, the quality of the parent raw material is a significant determinant of the quality of the final output. Thus, the finished product is often of poor quality and the customer is dissatisfied. Poor quality also results from inadequate process control, particularly when innovative technology is used.

26. Several factors contribute to this situation. Firstly, in most developing countries, there are few standards for low-cost indigenous building materials. Standards institutions are available in several countries but their priorities often lie outside the indigenous building materials sector. The absence of foreign or international standards for these materials also makes the task of formulation of new standards, particularly for innovative materials, more difficult.

27. Often the availability of a single standard may result in restrictive use of the product. This is particularly true of low-cost alternative binders, which can vary in quality and strength, depending on the grade of parent material and the use of admixtures. Since strength criteria are generally low in low-cost applications, for example, in low-income housing, formulation of

---

9/ Small-Scale Building Materials Production in the Context of the Informal Economy, UNCHS, HS/45/84/E, 1984.

graded standards can go a long way in the exploitation of natural resources of the country and in promoting the use of low-cost indigenous building materials. It is noteworthy that China has developed as many as eight different standards for cement, mainly to promote the production of mini-cement plants 10/.

28. Even though standards are the basic framework for promoting quality in production, their enforceability and the user environment are equally important in ultimate quality assurance. The absence of necessary quality-control infrastructure in the low-cost building materials industries (e.g. testing facilities, lack of special skills, etc.) and the general lack of quality consciousness on the part of the small producers (accentuated by the general indifference and less-demanding attitude towards quality of the user market, predominantly of low-income groups), all contribute to the poor quality assurance in the low-cost building materials sector.

(d) Demand for indigenous materials

29. The growth of the low-cost indigenous building materials industry is largely demand-driven, the majority of which originate from low-income house builders. The price of indigenous building materials in relation to other comparable materials (produced by the modern sector) is an important determinant of this demand. Thus, the demand for indigenous cementitious materials largely depends on their market price in relation to the market price of Portland cement. In many developing countries, a major constraint to the wide adoption of these alternative binders has been the failure to command a distinct price advantage on the market. Several factors have contributed to this situation: Portland cement particularly enjoys one or other form of subsidy in most countries. Even locally-produced Portland cement is often subject to price controls or receives freight equalisation subsidies in order to remain competitive with alternative binders.

Other imported basic building materials also usually benefit from import subsidies, exchange rate policies and certain trade policies. Effective government policies which eliminate such distortion in prices will go a long way in promoting the use of indigenous building materials.

30. The inflexibility of existing building regulations, which continue to promote imported building materials, or those produced by the modern sector, is another stumbling block to the increased utilisation of low-cost indigenous building materials. Government-sponsored housing and related construction projects are usually accorded a high status symbol in low-income settlements, but existing building regulations often obstruct the use of low-cost materials in such projects. However, it is encouraging to note that several countries are now adopting separate building regulations for low-income urban settlements 11/. Regional and international co-operation could be particularly useful here to share the experiences of successful country initiatives in this area.

10/ R.J.S. Spence. Appropriate Technologies for Small-Scale Production of Cement and Cementitious Materials. Monograph No. 12 on Appropriate Industrial Technology, UNIDO, 1980.

11/ The Reformulation of Building Acts, Regulations and Codes in African Countries, UNCHS, HS/81/85/E, 1985.

(e) Use of low-cost materials in construction

31. The absence of requisite artisan skills in the construction sector for appropriate use of indigenous building materials is often a major obstacle, particularly in introducing innovative materials to the market. An indigenous building material can be sold at a low price on the market; nevertheless, where construction skills are deficient, the overall objective of low-cost construction is defeated - either because of the excessive use of materials in construction or through inappropriate application. In most cases, skills in using indigenous materials in construction are taken for granted overlooking the fact that some indigenous building materials are relatively new to local craftsmen who need special training or orientation for proper application of these materials. Thus, in many instances, innovative materials remain unpopular and do not find wide adoption due to artisan prejudices born of ignorance or non-familiarity. Formulation of codes of practice and specifications for use of low-cost materials in construction could remedy the situation to a great extent.

IV. FINAL CONSIDERATIONS

32. A critical analysis of the constraints that currently inhibit the growth of the low-cost indigenous building materials industry in developing countries, as briefly outlined in the foregoing text, will provide the essential framework for the formulation of a set of practical measures at industry, sub-national, national, regional and international levels that could accelerate its balanced growth by fully harnessing the indigenous factors of production. In its deliberations, the Consultation may follow a structured approach, concentrating, in turn, on the following key areas of intervention, which, taken together, would provide a comprehensive set of measures and actions to realize the objectives of this exercise.

33. The first of these relates to Government policy measures that are necessary and constitute a prerequisite for the revitalisation of the low-cost indigenous building materials industry. Since the industry is inextricably interwined with the small-scale sector and the informal sector of the productive economy, intervention will be required in wide-ranging areas of public policy, particularly in domains of fiscal policy (e.g. tariff protection to fledgling industries), investment policy (tax concessions and other incentives to small-scale and informal sector operations), technology policy (increasing emphasis on labour-intensive technologies, optimum exploitation of the natural resource endowment of each country, etc.), and manpower development policy (upgrading the skills and entrepreneurial capacity of the traditional and informal sectors, and facilitating mobility between these and the modern sector).

34. Secondly, in the area of institutional support measures, the widely varying capacities at country level provide considerable scope for regional and South-South co-operation, apart from national initiatives. Gearing up local capacities for prospecting of small-scale deposits of raw materials will be vital. Development of special skills, particularly for innovative technologies, both at production and application levels, will also be important. However, perhaps the most crucial area of institutional support would be to extend and expand credit facilities to small-scale producers. Redirection of R+D efforts through suitable institutional reforms and improvement of flow of information from research and development institutions to the industry will be other important areas for consideration.

35. Thirdly, effective promotional measures will be equally crucial for the development of the low-cost building materials sector and will need a well co-ordinated domestic effort and international co-operation. Important promotional measures would include formulation and documentation of appropriate standards and specifications for the production and utilisation of low-cost indigenous building materials, reformulation of building regulations to bring them in line with the needs and price range of the low-income groups, and stimulation of demand by organisation of demonstration projects to popularise these materials.

36. Finally, in its deliberations the Consultation may like to keep in view, among others, the following thrust areas for national action and international co-operation:

(i) Reinforcement of the linkages between the low-cost building materials sector and the modern sector (covered by Issue I) for a holistic and complementary growth of the building materials industry, through intra-industry sharing of technology and skills, and optimal and sustainable exploitation of national resources, with the ultimate aim of accelerating the economic and social advancement of developing countries;

(ii) Strengthening of the small-scale industries in the low-cost building materials sector through well co-ordinated and coherent policies, institutional support, and promotional measures to facilitate the progressive transition of these industries into the modern sector;

(iii) Promotion of the redirection of research efforts in national R+D institutions towards development of innovative technologies for production of low-cost indigenous building materials and also for the elimination of current technological constraints, particularly with regard to improving quality and reducing costs in small-scale enterprises;

(iv) Intensifying efforts to transfer appropriate technologies to the low-cost indigenous building materials industries through international co-operation; similarities of factor proportions in production, and common constraints faced by the developing countries, make regional and South-South co-operation advantageous in this field;

(v) Provision of industrial extension services to small-scale entrepreneurs to facilitate setting up new ventures or expanding existing capacities. Such services should include:

(a) preparation of techno-economic feasibility studies which could help entrepreneurs to secure long-term and short-term capital from financial institutions;

(b) advice to entrepreneurs on choice of technology, selection and procurement of equipment;

(c) provision of information to entrepreneurs on location of raw material deposits, exploitable reserves and their quality;

(d) assistance to entrepreneurs in improvement of management capabilities, particularly in areas relating to marketing, financial accounting, cost accounting, factory legislation, personnel relations, etc.;

Availability of such consultancy services for resolving operational problems of small enterprises is an important element in improving the efficiency and productivity of the low-cost indigenous building materials industries;

(vi) Promotion of the development of industrial co-operatives in the low-cost building materials sector as a means of strengthening the informal sector operations through necessary policy, institutional and promotional support measures. The co-operatives can bring economy of scale in production and improve the bargaining power of the small producers, both in respect of access to basic inputs as well as in marketing operations;

(vii) Promotion of standards and specifications and other regulatory measures for greater utilisation of low-cost indigenous building materials in the construction industry, particularly in low-income housing and government-sponsored projects;

(viii) Promotion of dissemination of information among prospective users, particularly low-income groups, on available low-cost alternatives to conventional building materials, through carefully conceived demonstration projects jointly executed with selected producers of low-cost materials;

(ix) Promotion of clean and energy-efficient technologies, and sustainable, environmentally-sound utilisation of natural resources in the low-cost building materials industry. The exploitation of natural resources in an indiscriminate and disorderly manner, often present in informal sector operations, affects the very sustainability of such actions and proves counter-productive in the long run. Effective disincentives to such operations are needed to be built into the existing policy and institutional framework.